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once one would infer there is no relationship between the phenomena. However, Mr. King analyzes the lines by subdividing them into groups, and concludes "that a close correspondence does not exist, but there is a general agreement as to magnitude of the two effects when the means of a large number of lines are considered." I should like to add, that the "means of a large number of lines," leaves much to be desired in the proof of a relationship. Mr. King's method of subdivision carries with it another suggestion. When he divides the separations into small, medium and large, he reduces the number of types of separation in each class. For clearly a line whose separation is small does not belong to the same type as one whose separation is large. Again he selects the ratio of each of three subdivisions to low, medium and high displacement respectively. This gives arbitrarily nine divisions. By this method he shows there is an approach toward uniformity in relative magnitude. The suggestion is, what may we expect when these groups are broken up into real series types? Comparing the three iron lines mentioned above gives nothing of promise, although close measurement may show two of them to agree. But in the absence of an established series one can not affirm that these lines belong together. If this point has any merit, it would be worth while to compare substances among whose lines definite series have been established.

The tabulated data for the author's two substances lack just one thing, viz., the ultra-violet spectrum, to make them the most complete study which has appeared.

B. E. MOORE

UNIVERSITY OF NEBRASKA,  
August, 1912

*Introduction to General Thermodynamics.*

By Professor HENRY A. PERKINS, Trinity College, Hartford. Wiley and Sons.

Recognizing the lack of suitable text-books in English on thermodynamics for students of physical chemistry, the author in writing this book has attempted to make good the deficiency.

The volume comprises some 225 pages of octavo size subdivided into eight chapters, the titles of which in order are: General Heat Relations; The First and Second Laws of Thermodynamics; Entropy; Thermodynamic Equations; Perfect Gases; Real Gases; Change of State; The Solution of Problems. At the end of the book there are eight tables giving gas constants, thermoelectric and calorimetric constants of certain substances, density and thermo-elastic coefficients of certain liquids and solids, critical and Van der Waals constants, coefficients of expansion of gases and relation of pressure units in various systems.

The methods of presentation and demonstration employed by the author are for the most part classical and it is therefore unnecessary to refer to them specifically. The emphasis laid upon the doctrine of available energy as a means of interpretation of the second law is notable. The various thermodynamic potentials and the phase rule of Gibbs receive appropriate attention. The last chapter is noteworthy on account of the large number of problems which are proposed for solution by the student. Solutions of typical problems are given.

The scope of the book appears to be quite adequate for the purposes which the author has in view. A remarkable amount of material is condensed into a small volume through the aid of mathematical expressions; and although the demands made upon the mathematical knowledge of the reader are not very great it would appear that the author probably intends the book to be used by students having the advantage of a competent instructor. Professor Perkins has, in writing this book, furnished a valuable addition to the English text-book literature of thermodynamics.

A. P. WILLS

*Astronomy in a Nutshell.* By GARRETT P. SERVISS. Illustrated. G. P. Putnam's Sons. 1912. Pp. xi + 261.

There are so many excellent popular books on astronomy and its different branches, that

a new work is unnecessary unless the author has new material to present or can place before the reader the old facts in a novel and interesting form. Judged on these lines, this book of Mr. Serviss is wholly unnecessary: it presents old material in a stereotyped, uninteresting and unattractive form. The explanations of many of the motions of the solar system are obscure, and fail to give the reader an adequate understanding of the underlying principles involved.

The book contains many illustrations, but the pictures in most cases bear no relation to the accompanying text. Photographs of the surface of the moon are scattered through the chapter devoted to definitions and explanations of such astronomical terms as horizon, zenith, altitude and azimuth; while amid the pages devoted to a description of the moon appear photographs of various nebulae.

CHARLES LANE POOR

*A Beginner's Star-book.* By KELVIN MC-KREADY. G. P. Putnam's Sons. 1912. Illustrated. Pp. vii + 148.

This little book is a beautifully printed and illustrated guide to the stars and star groups. The star charts and key maps, intended as guides for the amateur observer, are arranged on a somewhat novel plan. For each season of the year two charts are printed, one showing the sky as the observer faces the south, the other the sky as the observer faces the north. This undoubtedly facilitates the finding of those stars situated either directly north or south and not too high above the horizon. But the charts are rather confusing when the star one seeks to locate is nearly overhead, or far to the east or west.

The illustrations, showing the principal nebulae and star groups of the heavens, are from photographs taken at the Yerkes Observatory, and are wonderful reproductions and triumphs of the printer's art. As a whole, the book is admirably adapted for its purpose, and should interest many in the study of the heavens.

CHARLES LANE POOR

# SPECIAL ARTICLES

## UROPHLYCTIS ALFALFÆ, A FUNGUS DISEASE OF ALFALFA OCCURRING IN OREGON

EARLY in the year 1910 the writer noted the occurrence of a crown gall disease of alfalfa in the Rogue River Valley near Medford, Oregon, but, on account of other pressing work, the character of the disease was not investigated until later. However, during 1911, owing to the fact that the disease began to show rather seriously in many of the large alfalfa fields, an investigation was begun and considerable field and laboratory work was done. An examination of a large number of fields with plants from two to seven years of age showed large areas where the plants had died, or where the growth had become very weak. On examining the plants within these areas, it was found that the crown and part of the stems just above the crowns were badly infected with numerous galls, varying from an eighth of an inch or less to sometimes four inches in diameter. These galls are much warted externally, and more often a large-appearing gall is made up of a number of smaller galls which have become united. Very rarely were there any galls found on the root system, and none at more than six inches below the surface of the ground as the plants stood in the field. The disease seems to affect the shoots or stems as well as the crowns and roots, and many specimens were found where the galls covered the stems fully five or six inches above the crowns. In the field, diseased plants usually show a very roughened crown from which only weak, chlorotic stems arise, the leaflets also being very small and lacking the normal green color. In the few references which the writer has had the opportunity to see, and which are cited below, it has been stated that the fungus was observed to be most destructive to plants on damp ground. My investigations have shown that this is not true. It has been found that even in the best drained sandy loam and gravel soils of this district (Rogue River Valley) the disease is quite as serious as in the heavy, poorly drained, "sticky" soils. It has been deter-